VASCULAR PLANTS OF THE CANYONLANDS UNIT OF THE BIG THICKET NATIONAL PRESERVE, TYLER COUNTY, TEXAS

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ABSTRACT

This is the first annotated checklist of the vascular plants of the Canyonlands Unit of the Big Thicket National Preserve located in southeast Texas. The Unit lies entirely within Tyler County, comprising 597.3 hectares. Currently this unit has 103 families, 246 genera, 388 species and 16 that are subspecies or varieties. Twenty nine of these 388 species are introduced to North America and 3 species are listed as noxious/invasive. The species are assembled into an annotated checklist including species origin, longevity and season of growth.

RESUMEN

Se presenta el primer catálogo de las plantas vasculares de la Unidad de Canyonlands de la Big Thicket National Preserve. La Big Thicket National Preserve está ubicada en el sureste de Texas. La Unidad de Canyonlands se encuentra totalmente dentro de el condado de Tyler, Texas comprendiendo 597.3 hectáreas. Actualmente esta unidad cuenta con 103 familias, 246 géneros, 388 especies, y 16 subespecies o variedad, de las que 29 son especies introducidas a América del Norte y 3 de estas especies son invasoras. Las especies se agrupan en una lista comentada con el origen de la especie, la longevidad y la temporada de crecimiento.

INTRODUCTION

This paper provides the first checklist of the vascular plants in the Canyonlands Unit of the Big Thicket National Preserve. The checklist will be utilized by ecologists and botanists interested in the flora of the Big Thicket National Preserve and southeastern Texas. It provides a list of plants that are currently found within this area. Wildlife biologists and wildlife ecologists can benefit from this checklist by using the data for implementing management practices within the unit. This information could also be helpful in determining the different wildlife species within the area. The checklist indicates the invasive/noxious plant species in the area and can serve as a starting point for tracking and managing these invasive species.

SITE DESCRIPTION

The Big Thicket National Preserve is located in the Pineywoods vegetation area (Hatch et al. 1990) of southeastern Texas. Established in 1974, it became America's first National Preserve with approximately 34,803 hectares (Peacock 1994). In 1981 the Preserve was designated a UNESCO Biosphere Reserve by the United Nations, and in 2001 the American Bird Conservancy designated the preserve as a Globally Important Bird Area. Today the preserve consists of just over 40,468.6 hectares, comprising 15 units that spread over parts of seven different counties in eastern Texas (Watson 2006). This project focuses on the Canyonlands Unit of the Big Thicket National Preserve (Fig. 1). The Big Thicket National Preserve acquired the Canyonlands Unit in 1993. It consists of 597.3 hectares, located on the eastern border of Tyler County along 5.63 km of the Neches River, on the east side of the unit.

Within these hectares are a variety of environments, including upland habitat (Fig. 2), wetland and riparian areas (Fig. 3), cypress swamps and pineywoods (Fig. 3). The Canyonlands Unit is made up of various canyons and topography changes with elevations ranging from 18.3–61 m above sea level. A floristic study was conducted on this unit to determine the number of the vascular plant species within the Canyonlands Unit. This floristic study occurred over parts of four years, November 2008–November 2011.

The climate for this area is described as subtropical (MacRoberts 2008). The average temperature for Tyler

County is 18.8–20°C with an average annual rainfall of 127–137 cm (CoCoRaHS 2012). This region has the highest average annual rainfall in Texas (MacRoberts 2008). However, during the study period this area of Texas received below average rainfall for both 2010 and 2011, 93 cm and 79 cm respectively.

The Canyonlands Unit is made up of a variety of 20 different soil types: sand, silt, clay or a combination of all three. The most abundant soil is the Estes Angelina Complex, which makes up 36% of the unit. It is a clay-dominated soil and is found in the bottomlands and low-lying areas. The second most abundant soil is the Woodville Fine Sandy Loam, which occurs on the slopes of the main canyons within the unit. For more specifics on soils, see Haile (2012).

METHODS

Eleven collection trips were made over the three year period. Trips were made during the different growing seasons in order to collect plant species while they were in flower and/or fruit. Each collection site within the unit was visited several times throughout the project to make a more complete checklist of the vascular plants within the Canyonlands Unit (Haile 2012). A voucher specimen and/or a photo were taken to document the species within the unit. The specimens of each species included in this checklist are housed in the S.M. Tracy Herbarium (Texas A&M University) including other holdings of the National Park Service.

Collection sites were determined based on soils, topography, and vegetation communities in an area. During collection trips up to four collectors were present in order to better cover each location. At each site the collectors would collect all the flowering vascular plant species that had not previously been collected. Once collections were made, each specimen received collection numbers, site descriptions, an associated species list, soil description and GPS locations. Before leaving the site, each specimen was pressed in a plant press and set to dry, later keyed, identified and verified.

Identifications for the species were made by using the following books, including: *Illustrated Flora of North Central Texas* (Diggs et al. 1999), *Illustrated Flora of East Texas, Volume 1* (Diggs et al. 2006), *Aquatic and Wetland Plants of Southeastern United States*: Dicotyledons (Godfrey & Wooten 1981), *Aquatic and Wetland Plants of Southeastern United States: Monocotyledons* (Godfrey & Wooten 1979), and *Gould's Grasses of Texas* (Hatch 2010), *Trees, Shrubs, & Woody Vines of East Texas* (Nixon 1985). Hatch (2010) was used for the current scientific names of all the Poaceae. The current scientific names for all other families and species were found at USDA Plants, and Diggs et al. (1999, 2006). Angiosperm Phylogeny Group (APG) classification system was used for placement of genera within families (Angiosperm Phylogeny website).

RESULTS AND DISCUSSION

The Canyonlands Unit has 103 families, 246 genera, and 388 species and 16 infraspecific taxa (Appendix 1). Figure 4 and Figure 5 are two species collected and documented for the unit. Of these 388 species, 29 are introduced and 3 are considered invasive/noxious. An invasive species is defined as a plant whose introduction causes or is likely to cause economic harm, environmental harm, or harm to human health (www.invasive.org). Invasive species are weedy species; they can be either native or introduced. The plants listed as invasive species are listed on the invasive and noxious weed list for Texas (USDA Plants).The four largest families in this unit were Poaceae (68 species), Asteraceae (43 species), Cyperaceae (23 species), and Fabaceae (18 species).

Floristic studies and the resulting species checklist of an area are never complete. It is estimated that this list includes 90 percent of the plant species within the unit. Due to the dry weather conditions that occurred during this study, some of the cool season annuals may not have been observed and collected. The next goal is to make future collecting trips to this unit in order to continue to add to this species checklist.

Appendix 1 is the annotated checklist of the vascular plant species observed and collected within the Canyonlands Unit of the Big Thicket National Preserve. The voucher specimens are housed at the S.M. Tracy Herbarium (TAES). The checklist is arranged first by phylum (Pteridophyta, Pinophyta, Magnoliophyta). Families are arranged alphabetically within phylum, genera are arranged alphabetically within family, and species are arranged alphabetically within each genus. The scientific name and authority is given for each of the species (Hatch et al. 1990; Diggs et al. 1999; Diggs et al. 2006; Hatch 2010), along with the longevity, origin,

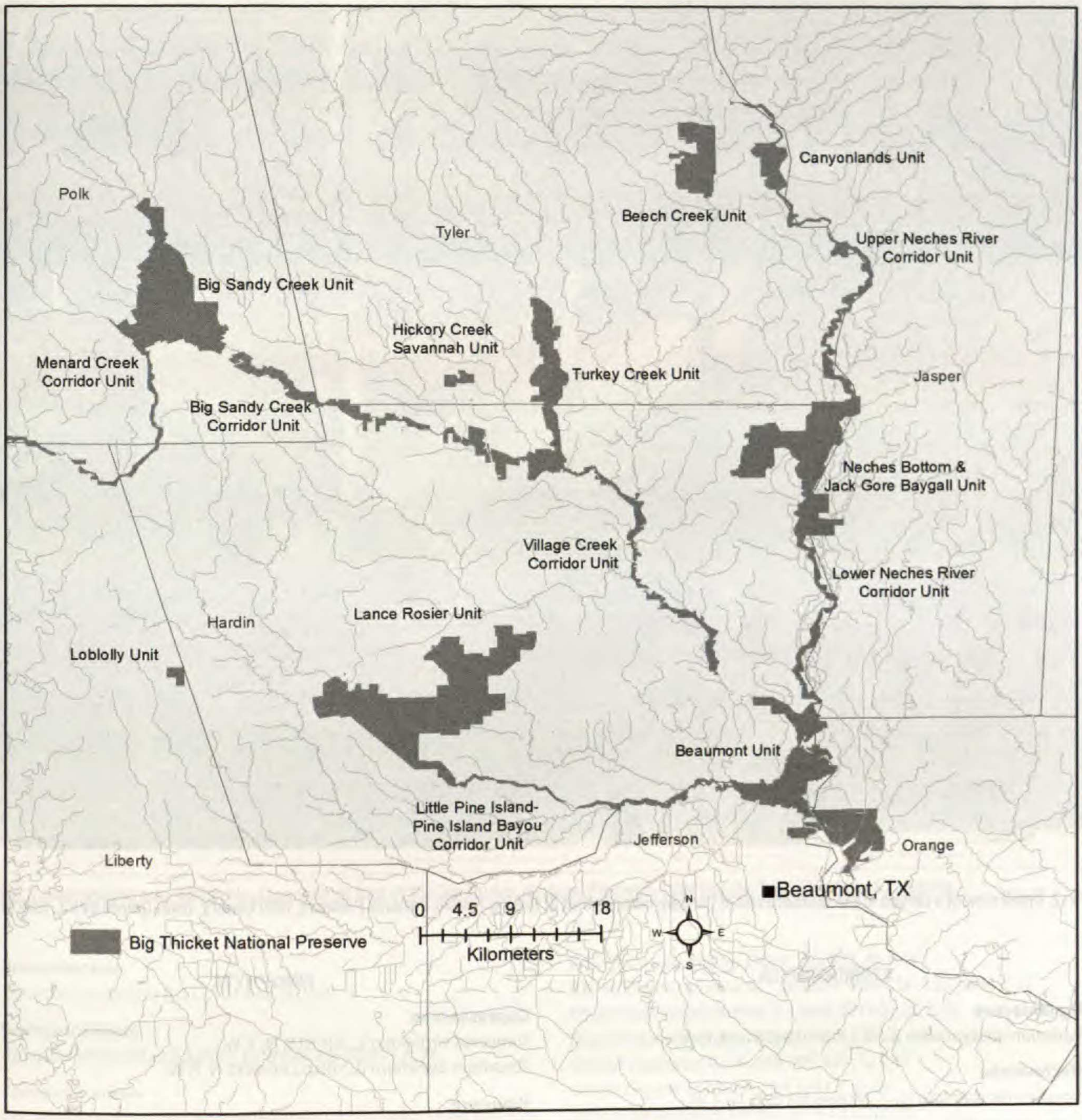

Fig. 1. Location of the Canyonlands Unit of the Big Thicket National Preserve, Tyler County, Texas.

and season of growth (Hatch et al. 1990). The invasive status for each of the species is denoted in the Appendix. Along with the above information, the collector's name and collection number are included in the checklist for each of the species.

APPENDIX 1

ANNOTATED LIST OF VASCULAR PLANTS

The checklist is broken into the major groups of vascular plants (Pteridophyta, Pinophyta, Magnoliophyta: Liliopsida, Magnoliopsida). Abbreviations used in the annotated checklist are as follows. **Collectors: AG** = Aminda Gallardo, **DK** = Dale Kruse, **KH** = Kelly Haile, **LB** = Larry Brown, **PR** = Paul Roling, **SH** = Stephan Hatch. **Origin: N** = Native, **I** = Introduced, **Longevity: A** = Annual, **P** = Perennial. **Season of Growth: W** = Warm-season growth, **C** = Cool-season growth, * = **I** nvasive species.

Fig. 2. Uphill view of a canyon in the southern end of the Canyonlands Unit of the Big Thicket National Preserve, Tyler County, Texas (photo by S.L. Hatch).

PTERIDOPHYTA

Aspleniaceae
Asplenium platyneuron (L.) B.S.P, SH 10696 a; N, P, W

Blechnaceae
Woodwardia areolata (L.) T. Moore, KH 626; N, P, W

Dryopteridaceae
Polystichum acrostichoides (Michx.) Schott, SH 10758; N, P, W

Osmundaceae
Osmunda cinnamomea L., AG 635; N, P, W
Osmunda regalis L., SH 10683; N, P, W

Polypodicaeae
Pleopeltis polypodioides (L.) Andrews & Windham, AG 523; N, P, W

Pteridaceae
Pteris multifida Poir., KH 459; I, P, W

Schizaeaceae
**Lygodium japonicum* (Thunb.) Sw., AG 580; I, P, W

Thelypteridaceae
Thelypteris kunthii (Desv.) Morton, SH 10686; N, P, W

Woodsiaceae
Athyrium filix-femina (L.) Roth, SH 10831; N, P, W
Onoclea sensibilis L., KH 628; N, P, W

PINOPHYTA

Cupressaceae
Juniperus virginiana L., KH 815; N, P, W
Taxodium distichum (L.) Rich., AG 600; N, P, W

Pinaceae
Pinus echinata Mill., AG 571; N, P, W
Pinus taeda L., AG 611; N, P, W

MAGNOLIOPHYTA: LILIOPSIDA

Agavaceae
Yucca louisianensis Trel., SH 10797; N, P, C

Alismataceae
Sagittaria platyphylla (Engelm.) J.G. Smith, KH 476 b; N, P, W

Alliaceae
Allium canadense L., SH 10766; N, P, C
Aletris aurea Walter, LB; N, P, W
Nothoscordum bivalve (L.) Britton, AG 615; N, P, C

Araceae
Arisaema dracontium(L.) Schott, KH 681; N, P, C
Arisaema triphyllum (L.) Schott, AG 642; N, P, C

Arecaceae
Sabal minor (Jacq.) Pers., SH 10751; N, P, W

Fig. 3. Bottomland area within the Canyonlands Unit of the Big Thicket National Preserve, Tyler County, Texas (Photo by S.L. Hatch).

Bromeliaceae
Tillandsia usneoides (L.) L., KH 415; N, P, W

Burmanniaceae
Apteria aphylla (Nutt.) Barnh. ex Small, AG 528; N, P, W

Commelinaceae
Commelina erecta L. var. *angustifolia* (Michx.) Fernald, KH 483; N, P, W
Commelina erecta L. var. *erecta,* SH 10650; N, P, W
Tradescantia hirsutiflora Bush, AG 420; N, P, C

Cyperaceae
Carex basiantha Steud., KH 675; N, P, C
Carex caroliniana Schwein., KH 713; N, P, C
Carex debilis Michx., KH 481; N, P, C
Carex frankii Kunth, KH 799; N, P, W
Carex glaucescens Elliott, AG 575; N, P, W
Carex leptalea Wahl., DK 1807; N, P, C
Carex louisianica L.H. Bailey, KH 544; N, P, C
Carex lupulina Willd., SH 10848; N, P, W
Carex scabrata Schwein., KH 547; N, P, W
Carex styloflexa Buckl., LB; N, P, C
Carex tribuloides Wahlenb., KH 763; N, P, C
Cyperus esculentus L., KH 477 b; N, P, W
Cyperus haspan L., KH 463; N, P, W
Cyperus plukenetii Fernald, KH 610; N, P, W
Cyperus retrorsus Chapm., KH 640; N, P, W
Cyperus virens Michx., KH 458; N, P, W
Rhynchospora caduca Elliott, AG 525; N, P, W
Rhynchospora globularis (Chapm.) Small, SH 10778; N, P, W
Rhynchospora glomerata (L.) Vahl, KH 430; N, P, W
Rhynchospora harveyi W. Boott, KH 715; N, P, W
Scirpus cyperinus (L.) Kunth, KH 459; N, P, W
Scleria oligantha Michx., SH 10813; N, P, C
Scleria triglomerata Michx., KH 430 a; N, P, C

Hypoxidaceae
Hypoxis hirsuta (L.) Coville, KH 870; N, P, C
Hypoxis curtissii Rose, LB; N, P, C

Iridaceae
Sisyrinchium campestre E.P. Bicknell, AG 623; N, P, C
Sisyrinchium langloisii Greene, SH 10669; N, P, C

Juncaceae
Juncus acuminatus Michx, SH 10847; N, P, C
Juncus coriaceus Mack., KH s.n.; N, P, C
Juncus effusus L., KH 479; N, P, W
Juncus polycephalus Michx., SH 10851; N, P, W
Luzula echinata (Small) F.J. Herm., SH 10821; N, P, C

Melanthiaceae
Trillium gracile J.D. Freeman, KH 704; N, P, C

Orchidaceae
Cypripedium kentuckiensis Reed, PR; N, P, W
Platanthera clavellata (Michx.) Luer, PR; N,P,W

Fig. 4. *Rhododendron canescens* in the Canyonlands Unit of the Big Thicket National Preserve, Tyler County, Texas (Photo by Robert Haile).

Poaceae

Agrostis elliottiana Schult., KH 691; N, A, C
Andropogon gerardii Vitman, KH 637; N, P, W
Andropogon glomeratus (Walter) Britton, KH s.n.; N, P, W
Andropogon gyrans Ashe, KH s.n.; N, P, W
Andropogon ternarius Michx., KH 601; N, P, W
Andropogon virginicus L., KH 549; N, P, W
Aristida lanosa Muhl. ex Elliott, KH 606; N, P, W
Aristida longespica Poir. var. *longespica,* KH 572; N, A, W
Aristida oligantha Michx., KH 588; N, A, W
Aristida purpurascens Poir. var. *purpurascens,* AG 510; N, P, W
Arundinaria gigantea (Walter) Muhl., KH 701; N, P, C
Axonopus fissifolius (Raddi) Kuhlm., SH 10655; N, P, W
Brachyelytrum erectum (Schreber) P. Beauv., SH 10839; N, P, C
Briza minor L., SH 10733; I, A, C
Chasmanthium latifolium (Michx.) Yates, AG 606; N, P, W
Chasmanthium laxum (L.) Yates, AG 520; N, P, W
Cynodon dactylon (L.) Pers., KH s.n.; I, P, W
Dichanthelium aciculare (Desv. ex Poir.) Gould & C. Clark var. *aciculare*, SH 10682; N, P, C
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *acuminatum*, SH 10651; N, P, C
Dichanthelium boscii (Poir.) Gould & C.A. Clark, SH 10763; N, P, C
Dichanthelium clandestinum (L.) Gould, SH 10692; N, P, C
Dichanthelium commutatum (Schult.) Gould, KH 501; N, P, C
Dichanthelium dichotomum (L.) Gould var. *dichotomum,* SH 10843; N, P, C
Dichanthelium dichotomum (L.) Gould var. *lucidium* (Ashe) Freckmann & Lelong, SH 10692; N, P, C
Dichanthelium dichotomum (L.) Gould var. *microcarpon* (Muhl. ex Elliott) Freckmann and Lelong, KH s.n., N, P, C
Dichanthelium laxiflorum (Lam.) Gould, AG 519; N, P, C

Fig. 5. *Sabatia campestris* in the Canyonlands Unit of the Big Thicket National Preserve, Tyler County, Texas (Photo by Robert Haile).

Dichanthelium nodatum (A. Hitchc. & Chase) Gould, KH 655; N, P, C
Dichanthelium oligosanthes (Schult.) Gould, SH 10800; N, P, C
Dichanthelium portoricense (Desv. ex Ham.) B.F. Hansen & Wunderlin, SH 10744; N, P, C
Dichanthelium ravenelii (Scribn. & Merr.) Gould, SH 10808; N, P, C
Dichanthelium sphaerocarpon (Elliott) Gould, SH 10772; N, P, C
Digitaria ischaemum (Schreb.) Schreb. ex Muhl., KH 610; N, P, W

Echinochloa walteri (Pursh) A. Heller, KH 636; N, A, W
Eragrostis capillaris (L.) Nees, KH 657; N, A, W
Eragrostis refracta (Muhl.) Scribn., KH 559; N, P, W
Eragrostis secundiflora J. Presl, KH 564; N, P, W
Eragrostis spectabilis (Pursh) Steud., AG 506; N, P, W
Gymnopogon ambiguus (Michx.) B.S.P., AG 571; N, P, W
Leersia lenticularis Michx., AG 589; N, P, W
Leersia oryzoides (L.) Sw., KH 638; N, P, W
Leersia virginica Willd., KH 522; N, P, W
Lolium perenne L., KH s.n.; I, A, C
Melica mutica Walter, KH 668; N, P, W
Mnesithea cylindrica (Michx.) Koning & Sosef, SH 10807; N, P, W
Oplismenus hirtellus (L.) P. Beauv., KH 512; I, P, W
Panicum anceps Michx., KH 853; N, P, W
Panicum brachyanthum Steud., KH 557; N, P, W
Panicum gymnocarpon Elliott, AG 599; N, P, W
Panicum hemitomon Schult., KH 880; N, P, W
Panicum hians Elliott, KH s.n.; N, P, W
Panicum rigidulum Bosc ex Nees, AG 574; N, P, W
Panicum verrucosum Muhl., AG 573; N, A, W
Paspalum floridanum Michx., AG s.n.; N, P, W
Paspalum fluitans (Elliott) Kunth, AG 593; N, A, W
Paspalum notatum Fluggé, KH s.n; I, P, W
Paspalum plicatulum Michx., KH s.n.; N, P, W
Paspalum setaceum Michx. var. *muhlenbergii* (Nash) D. Banks, AG 595; N, P, W
Paspalum setaceum Michx. var. *setaceum* (Nash) D. Banks, KH 556; N, P, W
Paspalum setaceum Michx. var. *stramineum* (Nash) D. Banks, AG 567; N, P, W
Paspalum urvillei Steud., SH 10809; I, P, W
Piptochaetium avenaceum (L.) Parodi, SH 10742; N, P, C
Poa annua L., AG 655; I, A, C
Poa autumnalis Muhl. ex Elliott, KH 702; N, P, C
Saccharum baldwinii Spreng., KH 630; N, P, W
Schizachyrium scoparium (Michx.) Nash, AG 509; N, P, W
Sorghastrum elliottii (C. Mohr) Nash, KH 609; N, P, W
Sphenopholis filiformis (Chapm.) Scribn., AG 608; N, P, C
Sphenopholis longiflora (Vasey) A. Hitchc., SH 10708; N, P, C
Sporobolus compositus (Poir.) Merr. var. *clandestinus* (Biehler) Wipff & S.D. Jones, KH 560; N, P, W
Sporobolus indicus (L.) R. Br., AG 560; I, P, W
Tridens flavus (L.) A. Hitchc. var. *chapmanii* (Small) Shinners, SH 10810; N, P, W
Tridens flavus (L.) A. Hitchc. var. *flavus*, KH s.n.; N, P, W
Vulpia octoflora (Walter) Rydb., SH 10731; N, A, C

Pontederiaceae
**Eichhornia crassipes* (Mart.) Solms, KH 634; I, P, W

Smilacaceae
Smilax bona-nox L., KH 846; N, P, C
Smilax glauca Walter, KH 594; N, P, C
Smilax laurifolia L., KH 614; N, P, C
Smilax pumila Walter, KH 741; N, P, C
Smilax rotundifolia L., KH 796; N, P, C
Smilax smallii Morong, KH 604; N, P, C
Smilax walteri Pursh, KH 797; N, P, C

Typhaceae
Typha domingensis Pers., KH s.n.; N, P, W
Typha latifolia L., KH 488; N, P, W

Xyridaceae
Xyris jupicai Rich., KH 457; N, P, W

MAGNOLIOPHYTA: MAGNOLIOPSIDA

Acanthaceae
Justicia ovata (Walter) Lindau., KH 470; N, P, W
Ruellia caroliniensis (Gmel.) Steud., SH 10718; N, P, W

Adoxaceae
Sambucus nigra L. subsp. *canadensis* (L.) R. Bolli, SH 10854; N, P, W

Altingiacaeae
Liquidambar styraciflua L., AG 531; N, P, C

Anacardiaceae
Rhus copallina L., KH 774; N, P, W
Toxicodendron radicans (L.) O. Ktze., SH photo; N, P, C

Annonaceae
Asimina parviflora (Michx.) Dunal, KH 443; N, P, C
Asimina triloba (L.) Dunal, KH 10684; N, P, C

Apiaceae
Chaerophyllum tainturieri Hook., AG 661; N, A, C
Cyclospermum leptophyllum (Pers.) Sprague ex Britton & P. Wilson, KH 752; I, A, W
Hydrocotyle verticillata Thumb., SH 10694; N, P, W

Apocynaceae
Amsonia glaberrima Woods. KH 759; N, P, W
Amsonia tabernaemontana Walter, LB; N, P, C
Asclepias perennis Walter, KH 751; N, P, W
Asclepias tuberosa L., SH 10713; N, P, W
Cynanchum laeve (Michx.) Pers., SH 10709; N, P, W
Trachelospermum difforme (Walter) A. Gray, SH 10894; N, P, W

Aquifoliaceae
Ilex coriacea (Pursh.) Chapm., KH 772; N, P, C
Ilex decidua Walter, KH 660; N, P, C
Ilex longipes Chapm. ex Trel., LB; N, P, C
Ilex opaca Soland., KH 425; N, P, C
Ilex vomitoria Soland., AG 522; N, P, C

Araliaceae
Aralia spinosa L., SH 10762; N, P, W

Asteraceae
Ambrosia psilostachya DC., KH 418 b; N, P, W
Amphiachyris dracunculoides (DC.) Nutt., KH 435; N, A, C
Baccharis halimifolia L., KH s.n.; N, P, W
Berlandiera betonicifolia (Hook.) Small, KH 409; N, P, C
Berlandiera pumila (Michx.) Nutt., SH 10738; N, P, C
Chrysopsis pilosa Nutt., KH 451; N, A, W
Cirsium horridulum Michx., KH 704; N, P, C
Conoclinum coelestinum (L.) Schott, KH 648; N, P, C
Conyza canadensis (L.) Cronquist, KH s.n.; N, A, W
Coreopsis grandiflora Sweet, SH 10762; N, P, C
Coreopsis linifolia Nutt., KH 645; N, P, C
Croptilon divaricatum (Nutt.) Raf., KH 568; N, A, W
Elephantopus carolinianus Raeusch., KH 420; N, P, W
Elephantopus nudatus A. Gray, KH 625; N, P, W
Erechtites hieraciifolia (L.) Raf. ex DC., AG 528; N, P, W
Erigeron strigosus Muhl. ex. Willd., KH 851; N, A, C
Eupatorium capillifolium (Lam.) Small, KH 548; N, P, W
Eupatorium perfoliatum L., SH 10855; N, P, W
Eupatorium rugosum Houtt., KH 578; N, P, W
Gaillardia aestivalis (Walter) H. Rock, KH 777; N, P, W
Gamochaeta purpurea (L.) Cabrera, KH 719; N, A, W
Helenium amarum (Raf.) H. Rock, SH 10729; N, A, W
Helenium elegans DC., SH 10857; N, A, W
Helianthemum carolinianum (Walter) Michx., LB; N, P, C
Helianthus angustifolius L., KH s.n.; N, P, W

Helianthus pauciflorus Nutt., KH 853 b; N, P, W
Heterotheca subaxillaris (Lam.) Britt. & Rusby, SH 10679; N, A, W
Hymenopappus artemisiifolius DC., SH 10717; N, P, W
Krigia occidentalis Nutt., KH 673; N, A, C
Krigia virginica (L.) Willd., LB; N, A, C
Liatris elegans (Walter) Michx., KH 435; N, P, W
Mikania scandens (L.) Willd., KH 525; N, P, W
Parthenium hysterophorus L., KH 646; N, A, W
Pityopsis graminifolia (Michx.) Nutt., KH 563; N, P, W
Pluchea camphorata (L.) DC., KH 517; N, P, W
Pluchea foetida (L.) DC., KH 529; N, P, W
Pyrrhopappus carolinianus (Walter) DC., SH 10730; N, A, W
Rudbeckia hirta L., KH 718; N, P, W
Solidago auriculata Shuttlew ex Blake, KH 530; *N, P, W*
Sonchus asper (L.) Hill, LB; I, A, W
Verbesina virginica L., KH 727; N, P, W
Vernonia missurica Raf., KH 513 a; N, P, W
Vernonia texana (A. Gray) Small, KH 857; N, P, W

Berberidaceae
Podophyllum peltatum L., AG 611; N, P, C

Betulaceae
Alnus serrulata (Dryand ex Ait.) Willd., AG 524; N, P, C
Carpinus caroliniana Walter, KH 763; N, P, C
Ostrya virginiana (Mill) K. Koch, KH 666; N, P, C

Bignoniaceae
Bignonia capreolata L., KH 466; N, P, C
Campsis radicans (L.) Seem ex Bureau, AG 582; N, P, W

Boraginaceae
Cynoglossum virginianum L., KH 859; N, P, C
Heliotropium indicum L., KH 635; I, P, W
Myosotis macrosperma Engelm., AG 660; N, A, C

Brassicaceae
Cardamine bulbosa (Schreb. ex Muhl.) Britton, KH 708; N, P, W

Campanulaceae
Lobelia appendiculata A. DC., KH 521; N, A, C
Lobelia cardinalis L., KH 551; N, P, W
Lobelia puberula Michx., KH 599; N, A, W
Triodanis perfoliata (L.) Nieuw., SH 10974; N, A, C
Wahlenbergia marginata (Thunb.) A. DC., SH 10799; N, A, C

Cannabaceae
Celtis tenuifolia Nutt., AG s.n.; N, P, C

Caprifoliaceae
Lonicera japonica Thunb., SH 10770; I, P, C
Lonicera sempervirens L., AG 647; N, P, C
Symphoricarpos orbiculata Moench, KH 658 a; N, P, W
Viburnum dentatum L., KH 418; N, P, W
Viburnum prunifolium L., KH 849; N, P, W
Viburnum rufidulum Raf., KH 671; N, P, C

Caryophyllaceae
Cerastium glomeratum Thuillier, KH 682; I, A, C

Convolvulaceae
Ipomoea cordatotriloba Dennst., SH 10811; N, P, W
Ipomoea pandurata (L.) Mey., KH 449; N, P, W

Cornaceae
Cornus florida L., SH 10714; N, P, C

Cyrillaceae
Cyrilla racemiflora L., KH 617; N, P, W

Droseraceae
Drosera capillaris Poir., AG 622; N, A, C

Ericaceae
Lyonia mariana (L.) D. Don, AG 646; N, P, W
Monotropa uniflora L., AG 508; N, P, C
Rhododendron canescens (Michx.) Sweet, AG 653; N, P, C (Fig. 4)
Vaccinium arboreum Marsh., KH 436; N, P, C
Vaccinium elliottii Chapm., KH 669; N, P, C

Euphorbiaceae
Chamaesyce cordifolia (Elliott) Small, KH 410; N, A, W
Cnidoscolus texanus (Müll. Arg.) Small, KH 876 a; N, P, W
Croton capitatus Michx., KH 446; N, A, W
Croton michauxii G.L. Webster, KH 768; N, A, W
Phyllanthus urinania L., LB; I, A, W
Sebastiana fruticosa (Bartr.) Fern., KH 429; N, P, W
Stillingia sylvatica L., KH 649; N, P, C
Tragia smallii Shinners, KH 770; N, P, W
**Triadica sebifera* (L.) Small, AG 545; I, P, W

Fabaceae
Albizia julibrissin Durazz., KH 725; I, P, W
Baptisia spp., (more material needed to make a more accurate identification), SH 10657; N, P, C
Baptisia nuttalliana Small, KH 885; N, P, C
Cercis canadensis L., KH 771; N, P, C
Chamaecrista fasciculata (Michx.) Greene, KH 435 b; N, A, W
Crotalaria sagittalis L., SH 10771; N, P, W
Dalea purpurea Vent., KH 853; N, P, W
Dioclea multiflora (T. & G.) Mohr, SH 10819; N, P, W
Erythrina herbacea L., SH 10798; N, P, C
Lespedeza hirta (L.) Hornem., KH 884; N, P, W
Mimosa hystricina (Small ex Britton & Rose) B.L.Turner. KH 716; N, P, W
Mimosa nuttallii (DC. ex Britton & Rose) B.L. Turner, SH 10740; N, P, W
Rhynchosia latifolia Nutt. ex Torr. & A. Gray, SH 10712; N, P, W
Sesbania drummondii (Rydb.) Cory, KH s.n.; N, P, W
Sesbania herbacea (Mill.) McVaugh, KH 475; N, A, W
Strophostyles umbellata (Muhl. ex Willd.) Britton, KH 437; N, A, W
Stylosanthes biflora (L.) B.S.P., KH 721; N, P, W
Tephrosia virginiana (L.) Pers., SH 10805; N, P, C

Fagaceae
Castanea pumila (L.) Mill., KH 517; N, P, C
Fagus grandifolia Ehrh., KH 531; N, P, C
Quercus alba L., KH 426; N, P, C
Quercus laurifolia Michx., KH 581; N, P, C
Quercus lyrata Walter, KH 471; N, P, C
Quercus macrocarpa Michx., KH 407; N, P, C
Quercus margarettae (Ashe) Small, SH 10770; N, P, C
Quercus marilandica Münchh., KH 438; N, P, C
Quercus michauxii Nutt., KH 794; N, P, C
Quercus nigra L., KH 482; N, P, C
Quercus phellos L., KH 742; N, P, C
Quercus stellata Wangenh., KH 874; N, P, C

Gelsemiaceae
Gelsemium sempervirens (L.) W.T. Aiton, KH 665; N, P, C

Gentianaceae
Sabatia campestris Nutt., KH 845; N, P, W (Fig. 5)

Haloragaceae
Myriophyllum aquaticum (Vell.) Verdc., AG 657; I, P, W
Proserpinaca palustris L., AG 562; N, P, W

Hamamalidaceae
Hamamelis virginiana L., AG 562; N, P, C
Hamamelis vernalis Sarg., KH 414; N, *P, C*

Hypericaceae
Hypericum galioides Lam., SH 10663; N, P, W

Hypericum hypericoides (L.) Crantz, SH 10685; N, P, W
Hypericum frondosum Michx., SH 10760; N, P, W

Iteaceae
Itea virginica L., KH 468; N, P, W

Juglandaceae
Carya aquatica (Michx. f.) Nutt., KH 437; N, P, C
Carya cordiformis (Wang.) K. Koch, SH 10795; N, P, C
Carya laciniosa (Michx. f.) G. Don, SH 10727; N, P, C
Carya texana Buckley, KH 587; N, P, C
Carya tomentosa (L.) Nutt., KH 451 ; N, P, C

Lamiaceae
Callicarpa americana L., KH 723; N, P, W
Monarda punctata L., KH 445; N, A, W
Salvia coccinea P.J. Buchoz ex Etlinger, LB; N, P, W
Salvia lyrata L., AG 627; N, P, C
Scutellaria cardiophylla Engelm. & A. Gray, SH 10715; N, P, W
Scutellaria parvula Michx. var. *parvula*, AG 628; N, P, C
Scutellaria ovata Hill, KH 728; N, P, W

Lauraceae
Persea borbonia (L.) Spreng., KH 664; N, P, W
Sassafras albidum (Nutt.) Nees, SH 10797; N, P, C

Lentibulariaceae
Utricularia radiata Small, KH 668; N, A, C

Linaceae
Linum medium (Planch.) Britton, SH 10774; N, P, C

Magnoliaceae
Magnolia grandiflora L., SH 10818; N, P, C
Magnolia virginiana L., SH 10855; N, P, C

Moraceae
Morus rubra L., SH 10817; N, P, C

Myricaceae
Myrica cerifera L, AG 634; N, P, C
Morella caroliniensis (Mill.) Small, N. P, C

Myrsinaceae
Anagallis arvensis L., SH 10858; I, A, C

Nyssaceae
Nyssa aquatica L., KH 484; N, P, C
Nyssa sylvatica Marshall., SH 10889; N, P, C

Oleaceae
Chionanthus virginicus L., AG 624; N, P, C
Fraxinus americana L., KH 532; N, P, C
Fraxinus caroliniana Mill, SH 10816; N, P, C
Fraxinus pennsylvanica Marsh., SH 10767; N, P, C
Ligustrum sinense Lour., KH 690; I, P, W

Onagraceae
Ludwigia decurrens Walter, KH 613; N, P, W

Orobanchaceae
Epifagus virginiana (L.) W. Bartram, DK 2524; N, P, W

Oxalidaceae
Oxalis stricta L., KH 671; N, P, C
Oxalis corniculata L., SH 10663; N, A, C

Passifloraceae
Passiflora incarnata L., KH 854; N, P, W

Phytolaccaceae
Phytolacca americana L., SH 10827; N, A, W

Plantaginaceae
Mecardonia procumbens (Mill.) Small, AG 659; N, P, W
Plantago aristata Michx., SH 10737; N, A, C
Plantago rhodosperma Decne., SH 10728; N, A, C
Scoparia dulcis L., KH 568; I, A, W

Platanaceae
Platanus occidentalis L., AG 579; N, P, C

Polygalaceae
Polygala incarnata L., KH 714 a; N, A, W
Polygala polygama Walter, SH 10663; N, P, C
Polygala sanguinea L., SH 10742; N, A, W

Polygonaceae
Brunnichia ovata (Walter) Shinners, KH 536; N, P, C
Polygonum hydropiperoides Michx., KH 458; N, P, W
Polygonum virginianum L., KH 523; N, A, W
Rumex hastatulus Baldw., SH 10812; N, A, C

Ranunculaceae
Clematis crispa L., SH 10893; N, P, C
Clematis pitcheri Torr. & A. Gray, SH 10726; N, P, W
Clematis reticulata Walter, KH 775; N, P, W
Ranunculus hispidus Michx., AG 656; N, P, C
Ranunculus pusillus Poir., AG 667; N, A, C

Rhamnaceae
Berchemia scandens (Hill) K. Koch, KH 766; N, P, C
Ceanothus americanus L., SH 10810; N, P, C
Frangula caroliniana (Walter) A. Gray, KH 778; N, P, C

Rosaceae
Crataegus marshallii Eggl., KH 844 a; N, P, C
Crataegus spathulata Michx., SH 10759; N, P, C
Duchesnea indica (Andrews) Focke, KH 528; I, P, C
Geum canadense Jacq., SH 10753; N, P, C
Prunus angustifolia Marshall., KH 693; N, P, C
Prunus umbellata Elliott, KH 848; N, P, C
Pyrus calleryana Decn., LB; I, P, C
Rubus aboriginum Rydb., AG 620; N, P, C
Rubus trivialis L.H. Bailey, AG 619; N, P, C
Spiraea cantoniensis Lour., LB; I, P, C

Rubiaceae
Cephalanthus occidentalis L., KH 856; N, P, W
Diodia virginiana L., KH 858; N, P, W
Galium obtusum Bigelow, SH 10703; N, P, C
Galium tinctorium (L.) Scop., AG 666; I, P, W
Houstonia micrantha (Shinners) Terrell, KH 690; N, A, C
Houstonia pusilla Schoepf, AG 620; N, A, C
Mitchella repens L., KH 510; N, P, C

Rutaceae
Zanthoxylum clava-herculis L., KH 651; N, P, C

Salicaceae
Populus deltoides Bartram ex Marshall., KH 847; N, P, C

Sapindaceae
Acer rubrum L., KH 579; N, P, C
Acer saccharum Marshall., KH 839; N, P, C
Aesculus pavia L., SH 10723; N, P, C

Sapotaceae
Sideroxylon lanuginosum Michx., KH 683; N, P, W

Saururaceae
Saururus cernuus L., SH 10682; N, P, W

Solanaceae
Solanum carolinense L., KH 781; N, P, W

Styrax grandifolius Ait., KH; N, P, C

Styracaceae
Halesia diptera Ellis, KH 467; N, P, C

Symplocaceae
Symplocos tinctoria (L.) L'Her., KH 626; N, P, C

Theophrastaceae
Samolus valerandi L., SH 10841; N, P, W

Tetrachondraceae
Polypremum procumbens L., KH 418; N, A, W

Ulmaceae
Planera aquatica J.F. Gmel., KH 474; N, P, C
Ulmus alata Michx., KH 863; N, P, C
Ulmus americana L., AG 514; N, P, C

Urticaceae
Pilea pumila (L.) A. Gray, KH 878; N, A, W

Verbenaceae
Glandularia canadensis (L.) Nutt., KH 670; N, P, W
Stylodon carneus (Medic.) Moldenke, LB; N, P, W
Verbena rigida Spreng., SH s.n.; I, P, W

Violaceae
Viola missouriensis Greene, KH 663; N, P, C
Viola primulifolia L., KH 678; N, P, C

Vitaceae
Parthenocissus quinquefolia (L.) Planch., KH s.n.; N, P, W
Vitis aestivalis Michx., KH 843; N, P, C
Vitis cinerea (Engelm.) Engelm. ex Millard var. *cinerea*, KH 736; N, P, C
Vitis rotundifolia Michx., KH 737; N, P, C
Vitis vulpina L., SH 10719; N, P, C

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